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(390)efRADIATION LABORATORY  
SAN FRANCISCO NAVAL SHIPYARD  
SAN FRANCISCO, 24, CALIFORNIA

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29 September 1947

## MEMORANDUM

From: D.F. Mastick  
 To: Cmdr. J.J. Fee  
 Dr. H.W. Hayes  
 Subj: Radiochemical Assay: Fuel Oil from the U.S.S. Independence

Classification changed to UNCLASSIFIED  
 by authority of CMC0-R.W. Lancaster  
 on 1-27-54  
 Date  
 (Signature) P. Hirschfeld  
 INDEPENDENCE  
 ALFA PLUTONIUM

1. Twenty-six tanks of oil containing a total of 273,700 gallons were individually sampled in a manner which included no water with the oil. In order to obtain a true composite sample, one ml. was taken from each sample for each 1000 gallons of oil in the tank from which the sample was obtained. This composite sample then was ~270 ml. in volume.

2. Ten ml. of this composite was dry ashed, the residue being dissolved in aqua regia. This solution was evaporated in a pre-counted milk ashing dish, giving 0.116 counts above total background. Using 3.25 c/s for the observed activity of a 70.5 d/s standard, we calculate:

$$\text{Total } \mu \text{ curies of Beta-Gamma} = 0.116 \times \frac{70.5}{3.25} \times \frac{3.79 \times 10^3}{10} \times \frac{2.74 \times 10^5}{3.61 \times 10^4}$$

$$= 7.2 \times 10^3 \mu \text{ curies per } 2.74 \times 10^5 \text{ gallons of oil}$$

3. The remaining 260 ml. of oil was subsequently dry ashed. During the evaporation to dryness the distillate was condensed. No activity was found. After ashing the residue was dissolved in  $\text{HNO}_3$  and analyzed by the TTA procedure. The final sample counted 11.39 c/a. Assuming 50% geometry for the parallel plate chamber and a specific activity of  $151 \times 10^3 \text{ c/a per } \mu\text{gram of Pu}^{239}$  we calculate:

$$\text{Total } \mu \text{ grams Pu}^{239} = \frac{11.4 \times 2 \times 3.79 \times 10^3 \times 2.74 \times 10^5}{260 \times 151 \times 10^3}$$

$$\approx 600 \mu\text{gram}$$

4. Reference is made to Morton's Medical Section Report 599 - (6xb) - MEM/jwc of 21 March 1947. As did Morton, we will assume each gallon of oil to be burned with a 10% excess of air, namely 1300 cu.ft. The

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assumption that the burning does not increase this volume of air and thus 1300 cu.ft. leave the stack for every gallon burned will also be retained as it evidently introduces a sizeable safety factor. The human respiratory rate is taken as 23,800 liters per 24 hr. day.

Morton's memo, "Radiochemical analysis of soot deposited on burning of oil from U.S.S. Gasconade, results of", to Officer-in-Charge dated 30 June 1947 establishes the fact that over 99.9% of Fission Products and Plutonium are carried out with the exhaust gases from the boilers.

Using the above data we calculate:

Micrograms Pu/liter evolved gas

$$= \frac{600}{2.74 \times 10^7 \times 1300 \times 23.3} = 5.96 \times 10^{-8} \text{ } \mu\text{g/l}$$

Inverting,

$$\frac{1}{5.96 \times 10^{-8}} = 1.68 \times 10^7 \text{ liters/} \mu\text{g Pu}^{239}$$

Number of days for an individual to inhale 1 microgram of Plutonium

$$= \frac{1.68 \times 10^7}{2.68 \times 10^4} = 583 \text{ days}$$

This assumes the individual breathes only the exit gases for 583 days.

It is also noted that the AEC tolerance level for plutonium in the atmosphere is tentatively set at  $5 \times 10^{-10} \mu\text{g/cc}$  of air for an 8 hr. working day, six days per week, for a one year period. Thus, on the basis of our assumptions and figures we have:

$$\frac{5.96 \times 10^{-11}}{5 \times 10^{-10}} = 0.12 \text{ of the AEC level.}$$

2E-14  
7E-12

5. On the basis of these results, it is recommended that the Radiological Advisory Committee be requested to consider this oil for use in the Shipyard boilers.

CC:  
Dr. Conrad, Chm., Rad. Advisory Com.

D.F. Mastick  
Acting Head Chemist

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